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Abstract

This paper aims to improve the understanding on how to implement effective technology transfer, which is difficult for Multinational corporations (MNCs) due to organizational barriers and market environment. We adopted an exploratory case study approach. A conceptual framework was introduced and enriched trough a case of a Japanese manufacturer of digital still camera (DSC).

Our case study explored that technology transfer could be achieved effectively in an MNC if it considers the subsidiaries' roles in both the home country and the host country as a whole enterprise, especially when the global market environment declines drastically. The study findings can help MNCs to achieve high-performance outcomes through effective implementation of technology transfer.

Issues about technology transfer in the existing literature are understood mainly from the perspective of the role of overseas subsidiary based on an assumption of a stable global market environment. They are unable to provide sufficient theoretical insight into a whole enterprise in actual unstable business environment. To address this knowledge gap, this study provided the new insights of implementing effective technology transfer from the perspectives of the subsidiaries' roles in both the host country and the home country, which was scarce in the past research.

Keywords: Multinational corporations (MNCs), assignment strategy, technology transfer, home country, host country, market environment, digital still camera (DSC)

1. Introduction

Technological innovations have become crucial in sustaining market competition and in acquiring competitive advantage. Developing countries face difficulties in gaining optimum benefits from technology transfer processes (Al-Abed et al., 2014). Technology transfer in MNCs remains one of the most important subjects for research in international

business (Buckley, 2002). MNCs as wholesalers of innovation play a significant role in diffusing technological knowledge throughout firms both nationally and internationally. In this regard, the knowledge for international technology transfer from a parent company to its subsidiaries is vital for both the parent and the subsidiary (Cui et al., 2006).

The host country where the technology is transferred could generate cash flow. It is also apparent that technology transfer could promote skills and the formation of human capital. Therefore, technology transfer brings numerous benefits to the host country. However, timely and appropriate decision regarding technology transfer is not easy owing to the barriers in many organizations between the parent and the subsidiaries pursuing those benefits, since core technology transfer is a source of numerous benefits. This is the real paradox accompanying by technology transfer.

Although there are numerous studies on technology transfer, the majority address inter-firm technology transfer mainly from the perspective of the role of overseas subsidiary based on an assumption of a stable global market environment such as growth stage. In that respect, a majority of cases focus on mass production by the subsidiary in developing countries, such as China, targeting cheaper cost while the core technology is developed by the subsidiary in the home country. However, numerous industries are now facing a decline stage of the market environment, which requires a more complex management of intra-firm transfer of technology than before. Therefore, those traditional research approaches are unable to provide sufficient theoretical insight into an whole enterprise in actual unstable business environment.

This paper contributes to the literature by focusing on the impact of the role of subsidiaries in both the home country and the host country on the performance of the technology transfer from Japan to China in Company X, a Japanese manufacturer of DSC, when the global demand declines drastically. DSC was chosen mainly because of frequent drastic market changes and MNCs in this industry must adapt to those changes to survive. The subsidiary in China is selected as a recipient of technology transfer because it targeting cheaper cost for mass production in the past, but now is facing a different stage to create backward integrated manufacturing. Company X is selected because it is among the few companies that could successfully transfer the core technology of lens from Japan to China in the DSC industry.

This paper addresses the following research question: How MNCs could implement effective technology transfer from the perspective of the subsidiaries' roles in both the home country and the host country in actual unstable business environment? In order to explore our research question, we introduce a conceptual framework modified from model of Birkinshaw and Hood (1996). In our discussion of technology transfer, we firstly argue that intra-firm transfer of technology in MNC should be achieved from the perspective of the subsidiary's roles in both the home country and the host country as a whole enterprise. In this line of arguments, we will emphasize a focus on how to promote effective technology transfer. In our case, the focus is on how to build organizational capabilities of a subsidiary in the host country for the absorption of the transferred technology. Under this focus, we draw an insight that the effectiveness of the technology transfer process is related strongly to the performance of the capabilities of transformation of a subsidiary in the home country. However, the generalization will remain a topic for future research.

Our methodology is case-based. Technology transfer under a new framework is contended in this study. It is expected to contribute both theoretically and practically to MNCs, hence, enriching the existing literature.

2. Literature Review

The literature on the key factors associated with technology transfer from parent to subsidiary in MNCs is reviewed. The key factors include strategy of assignment evolution, market environment and technology transfer, the concept of technology transfer, MNCs and technology transfer, the process of technology transfer in MNCs, and performance of technology transfer.

2-1. Strategy of Assignment

Researchers typically assume that ownership advantages are developed at the corporate headquarters and leveraged overseas through the transfer of technology to a network of foreign subsidiaries (Dunning; 1981; Vernon, 1966). As these overseas subsidiaries expanded and developed their unique resources, many studies showed that the corporate headquarters was no longer the sole source of competitive advantage for an MNC. The earlier literature developed models such as transnational (Bartlett and Ghoshal, 1989) to reflect the critical role played by many subsidiaries in the competitiveness of corporations. Then, academic attention shifted to understanding the new roles played by subsidiaries. Implicit in this shift in academic attention has been the concept of subsidiary evolution. It is well known that subsidiaries evolve over the years, typically through accruing resources and development of specialized capabilities (Hedlund, 1986; Prahalad and Doz, 1981). Several established typologies exits that suggest varied roles and responsibilities for subsidiaries (e.g., Bartlett and Ghoshal, 1986; Gupta, and Govindarajan, 1991, 1994; White and Poynter, 1984). To understand how subsidiaries modify their roles, Birkinshaw and Hood (1996) proposed generic processes of subsidiary evolution and identified the contextual factors expected to influence each factor from the head office assignment, subsidiary choice, and local environment determinism perspective (Figure 1).

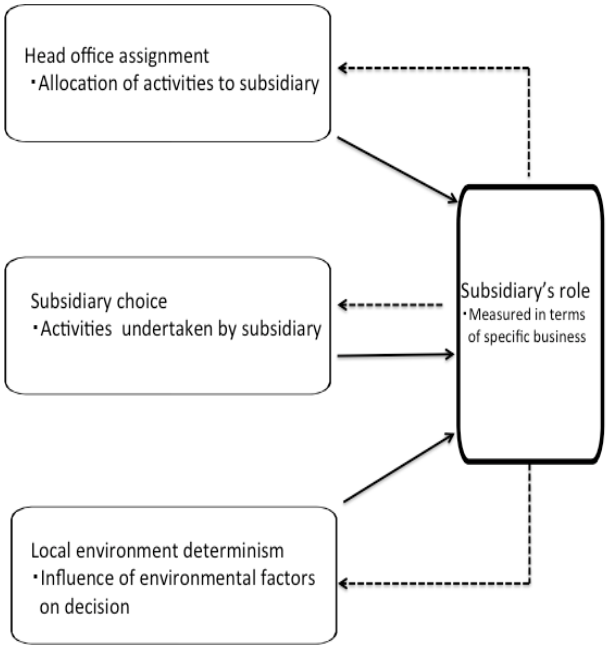

Figure 1- Frame of Birkinshaw and Hood (1996)

Although there are several researches on MNCs, they are mainly from the perspective of subsidiary's role in the host country, but not in the home country.

Market Environment and Technology Transfer

Cui et al. (2006) state that country-specific environments determine the nature and intensity of competition, the mechanism of organizational transactions, and the input–output motion of local industries. Furthermore, a firm's strategic initiatives arise directly from the environment within which it operates. Environmental factors form the basic ingredients based on which firms make strategic decisions. Miles and Snow (1978) contend that the market environment is responsible for the strategic orientation of a firm. By aligning certain general strategies with the market environment conditions, the firm could optimize performance.

In a competitive market, the key garner competitive edge is to provide inimitable and high-quality products to local consumers. Technology transfer from the parent company allows subsidiaries to reduce production costs and prices, adapt product design to the growing demands of the local market, and improve product quality, thus, enabling them to compete for market shares (Fazal et al., 2016).

Although the strategic initiatives of a firm for technology transfer are a direct consequence of the market environment, the extant literature largely addresses the issues related to the growth stage of the product lifecycle in a market environment when MNCs pursue cost reduction, but are not related to other stages of the lifecycle such as the decline stage, which requires more difficult management.

2-2. The Concept of Technology Transfer

The process of technology transfer may appear as simple as shifting codified information from one organization to another or as complex because the ability to understand and use information varies. Farizah and Mohd (2012) state that technology transfer consists of three basic stages: planning or strategy building, negotiation, and implementation. This would result in successful technology transfer and not just exchange of information between parties. Rahimi et al. (2013) stated that technology transfer is a substitute for developing and adopting technology from others. Minbaeva et al. (2003) define technology transfer as a process that initiates when the technology-receiving unit begins utilizing the transferred technology. The key element in technology transfer is not the actual knowledge; instead, it is the extent of a receiver's capabilities to use the new knowledge in their own operations. Al-Abed et al. (2014) recognized technology transfer as an extensive and complicated process for both the sender and the receiver of technology, whereby the recipient must be able to utilize, reproduce, improvise, and resell the innovation at the end of the process. In contrast to transferring general goods, technology transfer is highly specialized and complex because the delivery is successful only when the transferred technology is used and it adds value to the receiver's competencies (Teasley et al., 2005).

However, these researches on the concept of technology transfer focused mainly on the subsidiary, and did not focus on both the subsidiary and the parent company.

2-3. MNCs and Technology Transfer

MNCs are established as both major manufacturers of technology and as a channel for the bulk transferring of technology. Technology transfer by multinational organizations is considered as intra-firm transfer because the property rights are not shared with any external party. Nune (2012) stated that MNCs can transmit technology to foreign associates in both tangible and intangible forms. According to Gunter and Philipp (2014),

MNCs are highly dynamic in making innovative technologies accessible by purchasing spin-offs or employing them as service providers.

Transfer of core technology has numerous benefits. However, timely and appropriate decision regarding technology transfer is not easy owing to the barriers in many organizations between the parent and the subsidiaries pursuing those benefits, since core technology transfer is a source of numerous benefits.

2-4.Performance of Technology Transfer

Waroonkun (2007) defined technology transfer performance as a result obtained by local counterparts through employing technology transfer projects with foreign affiliates. From an organizational perspective, Rose et al. (2009) stated that technology transfer performance comprises learning, acquiring, absorbing, and utilizing capabilities of innovative external knowledge and technologies deeply entrenched within the materials of product, tangible assets, production and procedures, and management skills, and is not just limited to possessing the capacity of operating, maintaining, or repairing machineries at the level of production.

Earlier studies categorize technology transfer performance based on four stages (Bradley et al., 1995; Narayanan and Lai, 1993; Santikarn, 1981). The first stage includes initiation when the technology is transferred to the recipient. In the second stage, the local workforce should be trained to skillfully employ the technology. The third stage specifies that technology is transferred only when it is disseminated among the different units of the recipient company through dynamic distribution activities. The fourth stage stipulates that when workers are able to adapt the transferred technology to the needs of their particular business environment, then, technology transfer is deemed successful.

Thus, prior literature on technology transfer performance considers mainly from the perspective of the subsidiary although the success of technology transfer cannot be judged solely by considering the subsidiary alone.

3. Cases

This paper considers an exploratory case study of supply chain collaboration in the real world. Yin (1994) claims that case studies are most appropriate for exploratory research. A Japanese manufacturing Company X makes digital still camera in a product assembly factory of a subsidiary in China, a lens (aspheric lens and lens units) component factory in a subsidiary in north Japan, with the R&D head office in central Japan. In Company X, in-house production of aspheric lens and lens units are defined as black box technology to achieve the best picture quality, which are regarded as their competitive advantages. This study highlights technology transfer from one lens factory in Japan to an assembly factory in China.

The cases represent a series of activities of backward integrated manufacturing in China with the support of core technology transfer of lens from Japan. This core technology transfer helped the factory in China to make significant financial improvement in 2015, recovering from the past financial deficit while the global market of DSC declined to almost one-third in quantity and almost half in amount in 2015 versus 2010.

The case study period is categorized into three to illustrate the notable characteristics of the activities of technology transfer: before 2011 (the time prior to these efforts of backward integrated manufacturing), from 2011 to 2012 (the first phase of backward

integrated manufacturing), and from 2013 to 2015 (the second phase of backward integrated manufacturing).

3-1. Data used

To confirm the validity and reliability of the research results, three different sources of data were used for this case study. First, qualitative data were collected by conducting in-depth interviews with 22 diverse executives from Company X from 2015 to 2017. Those interviewed included 5 managers from the head office in Japan, 5 from the lens factory in Japan, and 12 (6 each Japanese and Chinese managers) from the assembly factory of Company X in China. These managers are responsible for planning, R&D, procurement, production, and marketing as they are in a core position to obtain information to identify the background, motives, objectives, structures, processes, roles and responsibilities, and performance evaluation between head office and subsidiaries. Each interview was documented carefully with their permission. All the interviews were tape-recorded and documented in detail. Formal, structured interviews were conducted to maintain consistency. Post interview analysis included comparison of the multiple interview results with the findings of earlier studies and additional questions were probed as needed. Appendixes A and B summarize the interview details and structured questionnaire.

Second, performance results and evolution of the Company's X factory in China from 2011 to 2015 are used as a key performance indicator of the adequate retaining ability of beneficiaries to transfer the technology. The comparative figures of the sales, fixed cost, marginal profit ratio, stock days, and profit ratio during 2011–2015 were collected. Such longitudinal case studies allow the examination of the stable and up-to-date evolving sets of manufacturing practices.

Third, to measure the global demand of DSC, the market data from 2009 to 2015 were obtained from Camera and Imaging Products Association (CIPA) in Japan. The market share data for Japanese manufacturers in 2011 of GfK, a market demand research company, were also used.

3-2. Digital Still Camera Market

Owing to commoditization of the compact category and decline in total demand, there has been stiff competition in the digital camera market. Camera-embedded smart phones have posed a big threat. There has been a sharp decline in the global demand for the compact category of DSCs since 2010. The global demand in 2015 versus 2010 was at level of one-third in quantity base, half in amount base (Table 1). Table 1 shows the global shipment evolution of Japanese manufacturers for DSC from 2009 to 2015 based on data from the CIPA in Japan. Since Japanese manufacturers represent a majority of the global market share for DSCs (77.9% for total DSC, 99% for interchangeable lens camera in 2011 based on the Gfk in Table 2), global shipment evolution of Japanese manufacturers for DSC could indicate the basic trend of the global market demand for DSC.

Table 1-Global demand evolution of DSC (Shipment base by Japanese Manufacturers)

Category	Shipment	2009	2010	2011	2012	2013	2014	2015
Total	Quantity (Millions pcs)	105.9	121.5	115.5	98.1	62.8	43.4	35.4
	Amount (Billions yen)	1,620.8	1,643.3	1,452.2	1,468.1	1,168.5	964.5	885.4
Built-in Lens (Compact)	Quantity (Millions pcs)	96.0	108.6	98.9	77.9	45.7	29.6	22.3
	Amount (Billions yen)	1,162.0	1,140.0	917.6	714.9	490.2	359.2	308.1
Interchageable Lens	Quantity (Millions pcs)	9.9	12.9	16.6	20.2	17.1	13.8	13.1
	Amount (Billions yen)	458.8	503.3	534.6	753.2	678.3	605.3	577.3

(Source: data of Camera and Imaging Products Association in Japan)

Table 2-Global market share of DSC by Japanese Manufacturers

Market Share	Total Category	Interchangeable Lens
Japanese Manufacturers (%)	77.9	99.0
Others (%)	22.1	1.0
Total	100.0	100.0

(Source: Gfk/Jan–Dec 2011)

When the market is in the growth stage, the global assignment between parent and subsidiary of MNC had been operated mainly based on cost, such as mass production in China as the host country, because of the cheap cost targeting for more business growth while the core technology developed in the home country. However, when the global market environment deteriorates such as in this case, Company X had to redesign the strategic assignment globally to overcome the challenges.

Contrary to the compact camera category, the demand for interchangeable lens camera category such as single-lens mirror-less or reflex camera has been increasing, because of the increased needs created by the development of social network service to capture good pictures without spending too much money.

Customers look for a product with desired features at the lowest possible price based on reputation and brand. For manufacturers, the pressure on price was tremendous because of the severe competition.

3-3. Digital Still Camera manufacturer Company X

Company X is one of the world's largest electronics manufacturing MNCs. It manufactures and markets a wide range of products under the Company X brand. Company X's head office is located in the center of Japan and operates one core technology factory for aspheric lens, lens units, and interchangeable lens camera in north of Japan and an assembly factory for total line up of compact category camera in China.

Compact category camera is now characterized by components having standardized interfaces, while interchangeable lens camera category includes components that are still

in close spatial relationship to each other and are highly synchronized and coordinated. As the compact category is already commoditized, Company X has been focusing on interchangeable lens camera category and lens units in which Company X could establish competitive advantages of manufacturing.

3-4. Aspheric Lens

Aspheric lenses technologies are important because they support the features of compact size, lightweight, and high-quality image of products. To assure a superior image quality while the reducing size and weight, the lenses of Company X feature a number of aspheric lenses that could lead to a smaller and lighter product. However, aspheric lenses are extremely difficult to produce because they require a high level of accuracy.

There are two kinds of lenses: glass and resin. Reliability is critical for a glass lens that is used mainly for automotive manufacturers, such as security camera in the car. Resin lens is for middle- to low-end use, such as the compact category of DSC.

3-5. Assembly Factory in China

Company X's factory in China that assembles DSCs is facing challenges to the profitability owing to the stiff competition. Although at the maturity stage of digital camera product lifecycle and stiff cost competition, the subsidiaries of Company X for DSC manufacturing were operated individually and the global operation from the perspective of total optimization was not executed yet. The factory in China was envisaged as a low-cost DSC production facility in the group.

In 2011, Mr. Y was assigned as the new managing director of China factory. He thought that the China factory would face huge problems when the market growth had saturated because there was no competitive advantage as a manufacturing factory and the major concerns of the China factory had been how to produce the ordered quantities of products without examining the customers, market, and competitors. In addition, he thought that there was no other way than to build a mechanism to clarify the role of each subsidiary and head office to maximize the strengths of total group to consolidate competitive advantages.

Under those circumstances, the China factory took up a challenge from 2011 to 2015 to build fundamental organizational capabilities for backward integrated manufacturing with the support of the transfer of core technology from Japan to China.

3-6. Preparing for Technology Transfer (2011)

First, Mr. Y sensitized all departments to the sense of crisis that the company would collapse if this situation continued. In parallel, repeated training was conducted to enhance the organizational capabilities for manufacturing. He also changed the wage system according to the degree of contribution. Hence, a sense of crisis was shared and a relationship of trust and interdependence was constructed gradually.

He focused on strengthening the factory based on three factors: equipment implementation, assembly line, and Supply Chain Management (SCM). Regarding equipment implementation, as equipment was often introduced with highly priced specification designed by the parent company in Japan, he downsized it locally in China to low-priced specification and used it exhaustively for 24 hours. Regarding the assembly line, he designed a line process based on postponement management in which the standardized parts were shared as much as possible until the finished product was rolled

out. Regarding SCM, there were significant improvements in the production lead-time (lead-time from the receiving orders to finishing the production) reduced by half as the results of improvement of purchasing process. All these improvements strengthened the basic capabilities for manufacturing.

3-7. First Phase of Backward Integrated Manufacturing (2012)

In 2012, an important action taken was the transfer of the lens units and resin lens from the lens factory in Japan to China although they were the source of competitive advantages for the DSC business of Company X. This is because resin lens was requested for further cutting down of the cost for middle- to low-end use such as compact category camera of DSC and the strong request for transfer from Mr. Y in China factory was made to the lens factory in Japan.

Consequently, the China factory could utilize all the support from Japan, including the abundant know-how on molding that, in turn, led to enhancing the organizational capabilities for backward integrated manufacturing in the China factory.

3-8. Second Phase of the Backward Integrated Manufacturing (from 2013 to 2015)

After establishing the strengths for equipment implementation, assembly line, and SCM, Mr. Y began to prepare for the development of new capabilities for the molding of lens. Generally, it takes nearly 10 years to build adequate capabilities with the necessary know-how to set up the molding business; however, he asked the parent and subsidiary in the home country to quickly share and transfer all the necessary know-how for molding, and the home country made the necessary arrangement for them.

After a series of activities of backward integrated manufacturing in China with the support of core technology transfer of lens from Japan, the factory in China achieved significant improvement of financial figures in 2015 (Table 3), recovering from the past financial deficit while the global market of DSC declined to almost one-third in quantity and almost half in amount in 2015 versus 2010.

Table 3- Performance evolution of China factory

	2011	2015
Sales	100	100
Fixed cost ratio (%)	100	75
Marginal profit ratio (%)	100	185
Stock days	100	67
Profit ratio (%)	100	400

Notes: Figures in 2015 are calculated based on the index 100 in 2011

3-9. Lens Factory in Japan

Lens molding and lens units are produced as core technology of Company X in the factory of north of Japan since 1987.

Behind the important action in 2012 to transfer the lens units and resin lens from the lens factory in Japan to China factory was the challenge of the lens factory in Japan. The transfer was to focus to produce glass lens technology to promote the diversity of the business from B2C to B2B based on the core technology of glass lens. Consequently, they

could realize the high reliability of glass lens at the level of heat resistance and durability requested from B2B customers. To build a competitive advantage, the lens factory in Japan focused on developing B2B customers who appreciate the value of its imaging products properly.

4. Discussion

Through a series of interviews, we examined the practices of technology transfer of a Japanese manufacturer of DSC that are now facing a drastically declining market environment. Figure 2 is an application of our model as an analysis frame to our cases that is modified from the model of Birkinshaw and Hood (1996). It shows how global assignment evolution in the home and the host country could be managed for effective technology transfer.

Company X's behavior in the case can be conceptualized by this new framework, which enabled it to achieve high-performance outcomes. Effective implementation of transfer technology depends on not only a function of how well a subsidiary in a host country evolves, but it also depends on how well a subsidiary in a home country (home country–based division) evolves, by taking into account of three factors, such as head office assignment, subsidiary choice, and local environment determinism. As this framework shows, the dyadic relationships between the home country and the host country in the same MNC are important for the success of transfer technology. Those dyadic relationships could help to develop new capabilities in the face of changing environments and evolving competition. MNC will sustain its competitive advantage only if it can continue to develop new capabilities such as our cases.

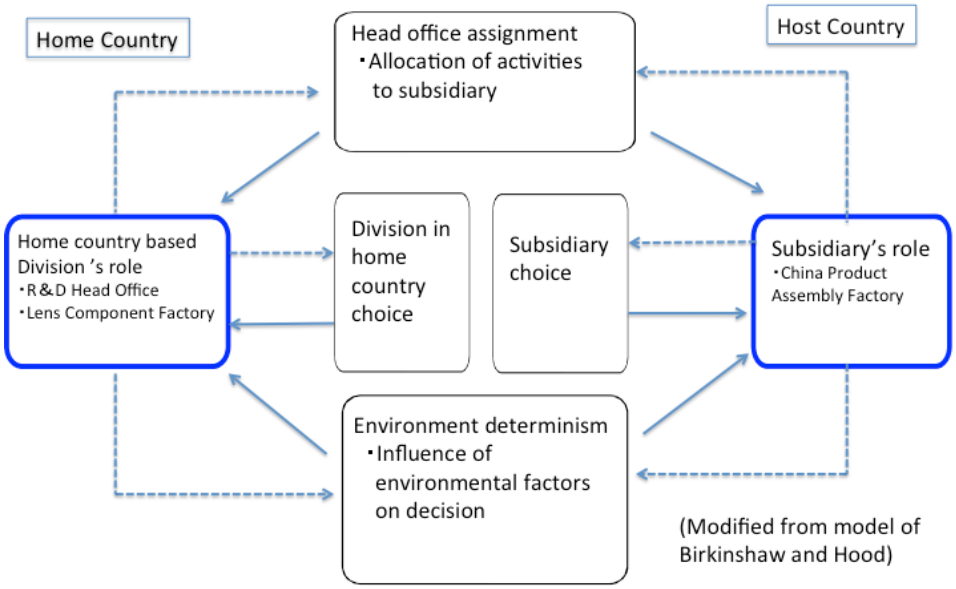

Figure 2- Framework of global assignment evolution for effective technology transfer (modified from model of Birkinshaw and Hood (1996))

This study explored three important findings. First, transfer of core technology is related to the source of competitive advantage in the home country; therefore, a timely and appropriate decision of technology transfer could not be taken owing to several organizational barriers. However, the transfer

of core technology of lens was made possible in this case because of the organizational capabilities of transformation of the subsidiary in the home country (home country–based division).

Second, the role of the home country did not end with technology transfer alone. It continued to help to build organizational capabilities of the overseas subsidiary with support ranging from the molding of resin lenses to human support.

Finally, these organizational capabilities in the home country would become the resources for the next step of growth in the long term as a total MNC, such as future B2B business of the subsidiary in China.

5. Conclusions

Technology transfer is critical to sustain market competition and acquire competitive advantage. It remains one of the most important subjects in MNCs research in international business (Buckley, 2002). However, owing to the complex process with many organizational barriers to pursue those advantages and direct influences from the context market environment, technology transfer is very complex and difficult for MNCs.

Research on technology transfer focused on the overseas subsidiary's role based on a rather simple assumption of global market environment of growth. However, numerous industries are now facing a decline stage of market environment, which requires a more complex management of intra-firm transfer of technology than before. Our case study explored that intra-firm transfer of technology could be achieved effectively in an MNC if it considers the subsidiaries' roles in both the home country and the host country as a whole enterprise, especially when the global market environment declines drastically.

The study findings make some important theoretical contribution. First, to achieve high-performance outcomes, it is meaningful to discover a new framework for effective implementation of technology transfer for MNCs who have difficulty in making timely and appropriate decisions.

Second, the head offices of MNCs should make effective decisions on technology transfer on how to support to overseas subsidiaries for successful implementation.

Finally, there is a need for stronger initiatives to have an independent ownership in the subsidiaries in both the host country and the home country to develop new capabilities in the face of changing environments and evolving competition, which in turn facilitate building competitive advantage for the whole MNC.

The study provided those new insights of implementing effective technology transfer from both the perspectives, that is, of the subsidiaries' roles in the host country and in the home country, which was scarce in the past research.

However, the study has some limitations. First, a sample of cases from various industries across various countries should be used to test the model outlined and the propositions made. The case of DSC in consumer electronics helped to test the issue of technology transfer and develop new concepts; however, the generalization of the study findings requires further investigation. Second, the study cases do not explore how a subsidiary in a home country (home country–based division) can build its capabilities of transformation as the key for success of transfer of core technology. Research on the desirable states is abundant, but few suggest how to realize such desirable states. This study would be on the next agenda. Finally, the cases were chosen such that the dyadic relationships between the home country and the host country in the same MNC could be highlighted. Expanding the present framework to supply chain networks to include the

supplier partners could be a final promising avenue for research to further test the framework and enrich it.

In conclusion, our framework of global assignment evolution for effective technology transfer introduced in this study is expected to provide meaningful insights from both the theoretical and practical standpoints. It opens up a new approach to study the impact of the subsidiaries' roles in both the home country and the host country on the performance of the technology transfer process.

Acknowledgments

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Appendix A. Interview details (date, organization, department, position and interview length)

The methodology and execution of the research are designed as follows: The research team (at least two people) visited each organization and met the executives at different times. The scheduling involved structured processes: (1) initial inquiries, (2) explanations of the purpose of the research, (3) permission from the individuals and their firm, and (4) then the actual interviews. Group interviews are conducted with all core functions of manufacturing such as Managing Director, R&D, procurement, production, and marketing when we visited the lens factory and assembly factory to understand the total flow of value chain for manufacturing. (5) Each interview was carefully recorded and documented for accuracy.

To ensure consistency, accuracy, and reliability of information gathered, multiple interviews for each organization were conducted. Post interview analysis included a comparison of our multiple interview results with the previous literature findings and additional questions were explored as needed. The interview period extended from 2015 to 2017 because of (1) the nature of the longitudinal project and (2) study of up-to-date evolving manufacturing practices of the firm. All the interview details are the basis of this study. To secure the confidentiality with the firm, the names have been changed.

Date(YY/MM/DD)	Organization	Department	Position	Hours
2015/1/15	Head office in Japan	Supply Chain Management Group	General Manager	2.5
2015/2/25	Head office in Japan	R&D Group	General Manager	1.5
2015/2/25	Head office in Japan	Procurement Group	General Manager	1.5
2015/2/25	Head office in Japan	Overseas Marketing Group	General Manager	1.5
2015/3/3	Manufacturing Subsidiary in Japan	Lens Factory	Group Total	3.0
			Managing Director	
			R&D	
			Procurement	
			Production	
			Marketing	
2015/3/16	Manufacturing Subsidiary in China	Assembly Factory	Group Total	5.0
			Managing Director	
			Planning	
			R&D	
			Procurement	
			Production	
			Marketing	
2016/9/30	Head office in Japan	Manufacturing Goup	General Manager	2.0
2016/12/2	Head office in Japan	Manufacturing Goup	General Manager	1.5
2017/3/6	Manufacturing Subsidiary in China	Assembly Factory	Group Total	5.0
			Managing Director	
			Planning	
			R&D	
			Procurement	
			Production	
			Marketing	
2017/3/15	Manufacturing Subsidiary in Japan	Lens Factory	Group Total	3.0
			Managing Director	
			R&D	
			Procurement	
			Production	
			Marketing	
2017/10/30	Manufacturing Subsidiary in China	Assembly Factory	Group Total	5.0
			Managing Director	
			Planning	
			R&D	
			Procurement	
			Production	
			Marketing	

Appendix B. Structured interview questions

In this interview, the focus of our questions is your firm's organizational effort to implement the technology transfer successfully.

(1) Macro-Issues related to technology transfer

1.1 What is the global strategy of DSC including the strategy of both parent and overseas subsidiaries in your firm?

1.2 What are the competitive advantages for your core technology?

1.3 How head office decides the allocation of activities to several overseas subsidiaries?

1.4 What are the primary reasons for transfer of core technology from parent to overseas subsidiaries?

1.5 What is the definition for mission and goals of each organization and organizational processes for transfer of core technology from parent to overseas subsidiaries?

1.6 What kind of supports from parent to overseas subsidiaries are implemented and to what extent?

1.7 What is the evaluation method to measure the performance for parent and overseas subsidiaries?

(2) Micro-Issues related to parent/subsidiaries and environment

2.1 What are the specific organizational processes (including organizational decision processes) for transfer of core technology?

2.2 What are the performance results of parent and overseas subsidiaries?

2.3 What is the global demand evolution of DSC?

2.4 How do you evaluate the current market environment?

2.5 How do you react to market environment changes?

(3) Issues with Implementation of transfer of core technology

3.1 What are the primary obstacles that prevent from successful transfer of core technology?

3.2 What factors drive the successful transfer of core technology?

3.3 What is the lead-time to accomplish to transfer of one core technology from parent to overseas subsidiaries?

3.4 How to develop the organizational capabilities of both parent and overseas subsidiaries?

3.5 To what extent does your organization share information with your counter parts in overseas subsidiaries (question to parent company)? To what extent does your organization share information with your counter parts in parent company (question to overseas subsidiaries)?

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